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Basket Willow Culture in Maryland

BY

KARL E. PFEIFFER, Assistant Forester

BALTIMORE, MARYLAND
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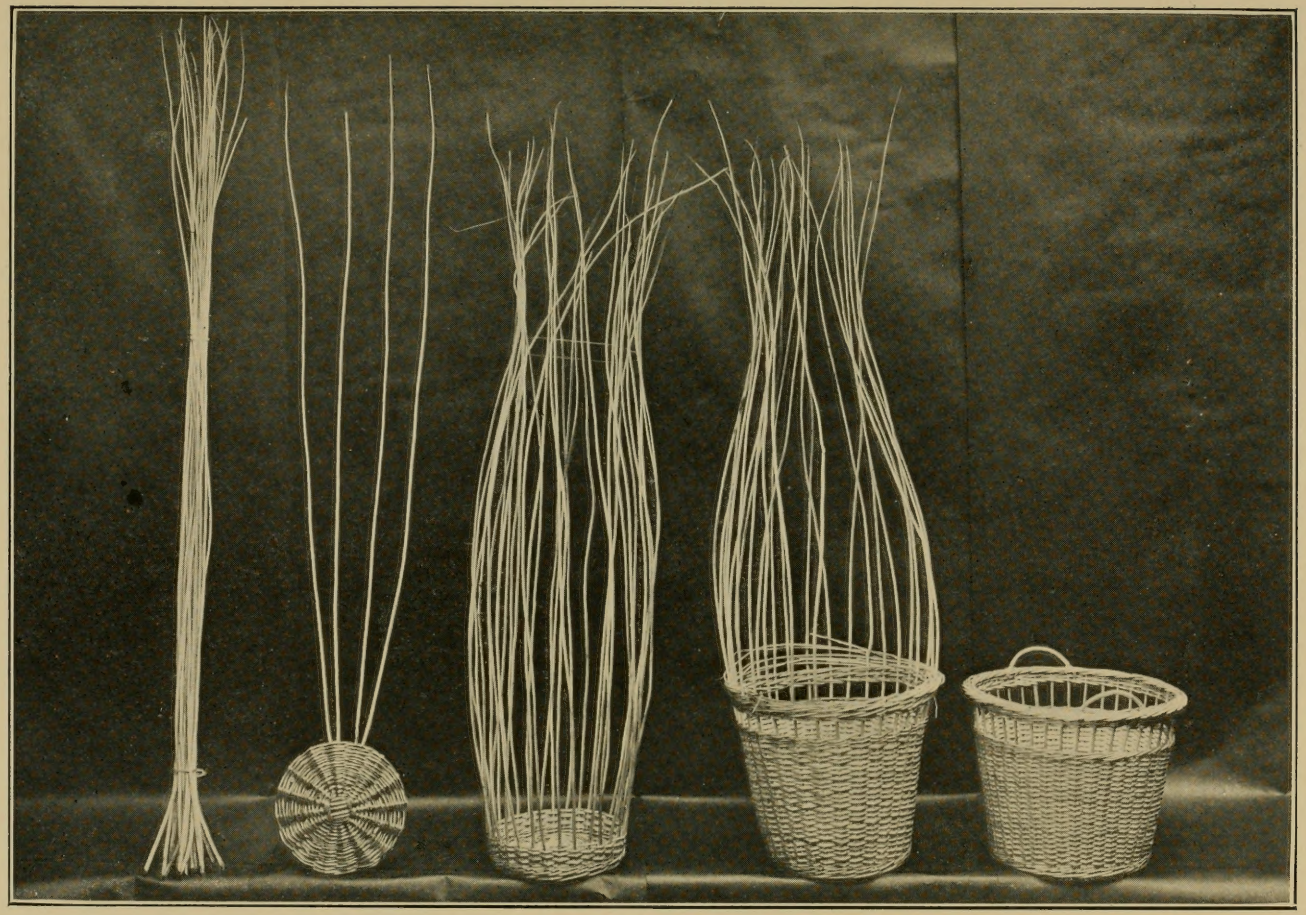

PLATE I

FIG. 1. FRONTISPIECE. GROWTH OF A WASTEPAPER BASKET

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BASKET WILLOW CULTURE IN MARYLAND

INTRODUCTION.

This report is intended to assist in a practical way those who contemplate commercial culture of basket willows, and at the same time be of aid to those already engaged in growing them. The information secured is therefore of purely local application. No attempt has been made to go into the general history of willow growing in the United States, or to study conditions or opportunities outside of Maryland. It is felt that this industry, for a long time of real importance to the State, may profitably be extended to other portions of Maryland where it is not now active, and be substantially enlarged in those sections where it is already well-known as a local industry.

The writer personally inspected most of the Maryland gardens in the summer of 1915, again in 1917, and subsequently to that time. The first survey was made in 1913 by Assistant Forester J. A. Cope, and his observations—especially on the enemies of the willow—were useful for purposes of comparison, as also in the compilation of the present report. The investigation has been extended over a period of years in order to secure average results, and data which will be at once authoritative and informing.

It is desired here to show appreciation to the members of the Scientific Staff for their assistance and criticisms, and to the United States Forest Service for access to their research files and many of the illustrations which contribute largely to the interest and value of the work.

Reference has also been made to the bibliography following:

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PLATE II

THE FOUR COMMON BASKET WILLOWS: AMERICAN GREEN. PATENT LEMLEY. LEMLEY AND WELSH

IMPORTANCE OF THE INDUSTRY IN MARYLAND.

From statistics gathered by the United States Forest Service,* Maryland is the second largest producer and the third largest consumer of willow rods in the Union, being surpassed in quantity only by New York and in consumption only by New York and Massachusetts. Maryland, however, is eighth in consumption of imported willows, thus showing that the willows grown in this State are practically all consumed locally and that very little in proportion is imported.

The willow industry in Maryland has declined in the past few years due to higher labor costs in this country. The cheap European willow had undoubtedly tended to somewhat cripple the willow industry in the United States before the war, but since then the scarcity of labor, together with its cost, have further depressed the industry.

Since the beginning of the European War, the supply of willows from Europe has been cut off and the American manufacturers are compelled to rely on native stocks. In some cases Japanese willows have supplanted those from Europe, but there is still a great demand for the native raw material. This has caused an advance in the price of home-grown willows and thus made their cultivation more profitable.

There is, in Maryland, a rather extensive trade in willow ware, the product going into baskets and furniture which are locally used.

Basket willows are not grown commercially in this State, over nearly as great a range as possible. Experiments conducted by the U. S. Forest Service show that the willows can be grown throughout Maryland, with the exception of the far western counties.

This is an excellent means for the utilization of the overflow lands and those not suitable for the production of good farm crops. There are many such places throughout the State, and there is no reason why the industry should not become a greater factor than it is.

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* Forest Service Circular 155.

SELECTION OF PLANTING SITE.

It is a common idea that willows grow only on marshy land—this is not the fact. They will grow on ground that is dry during the summer but wet in the winter and spring. The ideal site for a willow garden, however, is one where the water table is within 2-6 feet of the surface, thus giving surface drainage, but a constant supply of water.

Basket willows, with favorable moisture conditions, will grow on a wide range of soils, although the best is a loose sandy loam.

Care should be taken to have the garden free from surrounding shelters, as these not only are likely to form frost pockets, which cause upheaval of the plants, but by checking the winds, and allowing the dew to remain on the plants till late in the day, invite insects attacks and fungous diseases. In addition there should be good drainage, if the land is low, as standing water is injurious to the plants and will eventually kill them if they are inundated too long.

If possible, the garden should be so situated that it will be convenient for the owner to visit and observe it frequently, as most insects, fungi and weeds may be checked if discovered in time.

It does not in the least harm the gardens to be overflowed in the spring. On the contrary, the sediment deposited by flooding fertilizes and builds up the soil about the stools or stumps, and also tends to exterminate the insects which have wintered in the crevices of the stumps and in the ground. Standing water is harmful, however, and should be drained off.

SOIL PREPARATION.

The best results are secured, in a garden that is started on land not previously cultivated, by plowing the ground the season before and using the land for crops, such as corn or potatoes. This loosens the soil. If the ground is too low for the production of farm crops, it should be properly drained and plowed in the spring and left free from weeds for a season. Late in the fall it should again be plowed and left to weather during the winter. In the spring, it should be plowed again and then harrowed. Great care should be taken to avoid depressions where water might stand.

A cheaper method often used, though with less satisfactory results

both in establishing the garden and in the crop for the first few years, is to clear the land of trees and brush, mow down the weeds and grasses and then burn all. The ashes of the burned rubbish should be strewn over the area to act as fertilizer. This is best done in the fall.

If the garden is to be started on land already used for crops, a plowing and harrowing in the spring is all that is necessary.

The more care given in preparing the planting site the better the chances of success—"for many failures to establish good gardens are due to the lack of proper preparation of the ground." Open ditches should be made in order to drain off any standing water, since this injures the stools.

* Farmers' Bulletin 622—U. S. Department of Agriculture.

KINDS TO PLANT.

American Green. (*Salix amygdalina L.*)

American Green is one of the best producing willows in this country. It has a tendency to hold its shape better than Lemley or Welsh, and the wood is a brilliant white and very flexible.

This willow grows best on fairly rich soils having a high degree of moisture, but will also grow on sandy situations, provided the water table is near the surface. The soil should not be too rich, for, while the rod produced is thicker and taller, the pith is much larger on account of the rapid growth, thus making the willow softer.

The American Green is much in demand for the making of furniture and for the heavier and better grades of basket ware. It is easily peeled, and because of its large size, the peeling can be done at a lower cost per pound. Unfortunately, though this variety is the best basket willow grown in America, it is very susceptible to insect attack and diseases, and requires continual watching to avoid harm.

The annual growth of the American Green ranges from 5-10 feet per annum with an average of 7 feet.

Lemley and Patent Lemley. (*Salix pentandra minor and major.*)

The Lemley and Patent Lemley are very similar and no distinction is made between the two in the gardens or in the market. For their cultivation, the most adaptable soil is a loose sandy loam

with an abundant supply of moisture. If possible, heavy soils should be avoided, but if the garden is to be located on such land it should be deeply plowed before planting. When planted on too rich soil, these willows, as in the case of the American Green, are liable to grow pithy, while on the upland poorer soils, the rate of growth is slow, with shorter though tougher rods.

The Lemleys attain a height of from 4-8 feet per annum, with an average of 6 feet, and are easily peeled by the sap method. They are also comparatively free from diseases and insects. One objection to the Lemleys is that they tend to branch at the base unless planted fairly close, and they are also inclined to curve at the base, making them harder to prepare for the market. While the Lemleys are somewhat smaller and less elastic than the American Green, their uses are similar.

However, it is not advisable to plant Lemleys exclusively, for a basket maker prefers some variety.

Welsh or Purple Willow. (*Salix purpurea L.*)

The Welsh willow never grows as tall as either the American Green or the Lemleys, and is much harder to peel, but gives a very tough and elastic rod which seldom branches.

It thrives best on moist, well-drained sandy loams, but will grow on a great variety of soils. It may be grown on rich soil without becoming soft and brittle; it may likewise be grown on hard soil that is comparatively dry. On such ground, however, the plants tend to become stunted. The Welsh willow can also stand the extremes of heat and cold and does reasonably well under a long dry spell. It is not very susceptible to insect or fungous attacks. The average growth is about 5 feet per annum, ranging from 3 to 7 feet depending upon soil conditions

The yield of Welsh is small, so that it should only be planted in conjunction with other species. This willow is used in the finer work of basketmaking and also when green, as cordage in the garden and in tree nurseries.

The following table showing the rank and relative value of American Green, Lemley and Welsh willows under average conditions in regard to matters influencing profitable production, may be found interesting, 1 being the best.

PLATE III

FIG. 1. TYPICAL MARYLAND WILLOW LAND. PART OF THE GARDEN HAS BEEN CUT. ELKRIDGE, HOWARD COUNTY

PLATE III

FIG. 2. A WELL-KEPT GARDEN, ELKRIDGE, HOWARD COUNTY

	American.	Lemley.	Welsh.
On wet soils	1	2	3
On dry soils	3	2	1
Yield per acre	1	2	3
For general purposes	1	2	3
Disease resistance	3	1	2
Continued productivity	1	3	2
Least cultivation necessary	1	2	3
Production of straight rods	2	3	1
Ease in peeling	1	2	3
Low cost of cuttings	2	3	1
Number of cuttings per 100 pounds of rods	3	2	1

George M. Lamb, U. S. Forest Service.

WHEN TO PLANT.

The best time for planting willows is during March or April, after the frost is out of the ground.

The ground is softest then and the work of "sticking" the cuttings in the ground is easiest. The roots have a chance to spread out more in the soft ground, taking a firmer hold and rendering the plant less liable to heaving the following winter.

Fall planting is possible on high dry ground where there is little danger of heaving. In this way the plants get an earlier start in the spring. It is, however, not as sure a method as planting in the spring.

CUTTINGS FOR PLANTING.

Cuttings for spring planting are best made during the late winter and should be undertaken at least six weeks before planting, thus giving them time to callous over at each end. If the planting is done in the autumn, the cuttings can be made either two weeks after the leaves have fallen from the shoot or still better, after the first few frosts have ripened the wood.

In making cuttings for planting, the ends should be made clean and smooth if the plants from the cuttings are not to be inferior. Such tools as corn knives or pruning shears should be used in making the cutting. Whichever tool is used, it should always be sharp.

Only good, round rods should be used for making cuttings. All of the rod except the two feet at the top can be used and each cutting should be about 12 inches long.

HOW TO STORE CUTTINGS FOR PLANTING.

The best way to store the cuttings until planting time, is to pack them in an upright position in a room where the temperature is low and even. They should be covered with sand which is moist, not wet, to a depth of about two inches. If the bottoms are in sand, and the tops covered with burlap or sacking, both ends will become properly calloused. When other material, such as sawdust, is used to cover up the cuttings, care should be taken to avoid heating, which is disastrous. Freezing will not injure the cuttings so long as they remain dormant, but repeated freezing and thawing should be guarded against.

STOCK USED.

Cuttings from one-year-old shoots may be used in establishing a new garden, although they are not as desirable as cuttings from the two-year-old shoots because the younger cuttings require more cultivation for the first few years, due to the fact that they are slower in developing. One-year-old cuttings should never be used for filling in vacancies in an established garden; the older plants will soon outgrow the new, eventually killing them by excessive shade. Also, one-year-old stock should never be used on poorly prepared, weedy ground or on soil in low physical condition. On the whole, the two-year planting stock will prove more satisfactory because it makes a hardier stool from the beginning.

When starting a new garden, it is best to secure cuttings about 10 to 18 inches long and place them in the ground from 8 to 14 inches deep, with the tops upward and leaving at least two buds above the ground. In filling in open places in an established garden, it is advisable to use 4 to 5 foot two-year-old stock, and place it in the ground to a depth of 10 to 12 inches. The longer rods are used in this connection because they are able to compete with the old stools; the shorter cuttings would be shaded out the first season.

Too great emphasis cannot be put on selecting good, sound shoots from which to get cuttings, as any defect or injury in the cutting may cause serious trouble later on. Cuttings should not be made from rods showing a discolored center, which indicates rot, as the stools will also become infected and the plant quickly destroyed.

Calloused cuttings are more apt to show better growth from the

PLATE IV

FIG. 1. WILLOW STOOLS FORCED OUT BY FROST, ELKRIDGE, HOWARD COUNTY

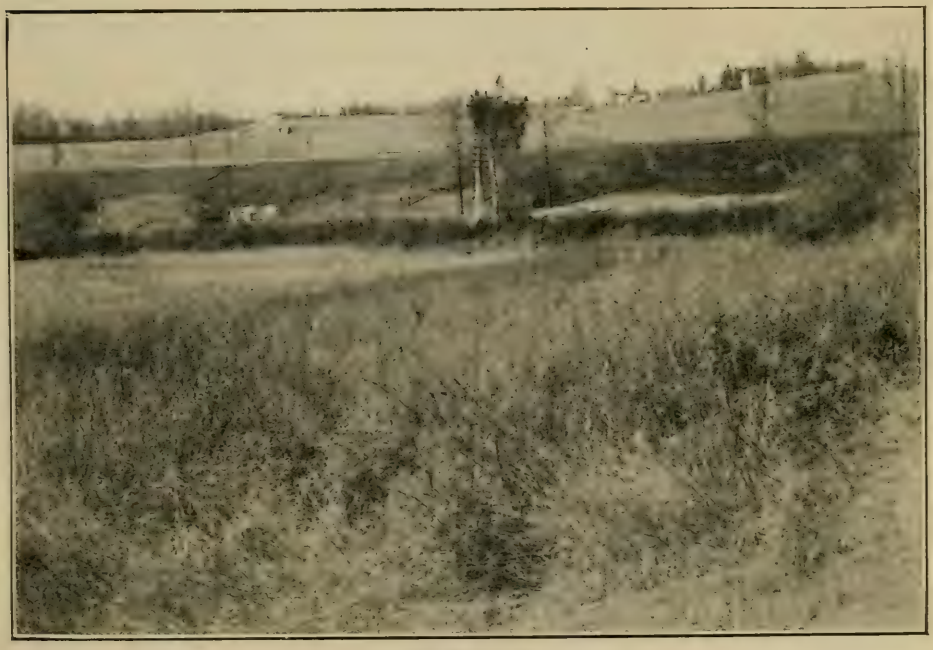

PLATE IV

FIG. 2. WILLOW GARDEN SERIOUSLY DAMAGED BY "WRAP" AND WEEDS, ELKRIDGE, HOWARD COTNTY

start than fresh ones. Cuttings made after growth has begun should never be used, as their chances of surviving are poor. One-year cuttings for planting can be purchased for about $3.00 a thousand; two-year cuttings, a foot long, for about $8.00 to $10.00 a thousand.

SPACING.

Spacing is one of the most important factors in the establishment of a garden. Close spacing reduces the weed crop after the garden has been established, and little cultivation is needed. If the spacing is too close, however, the air circulation of the garden is poor and the vitality impaired.

With the American Green, close spacing is advantageous, for while it will not grow quite as high it will produce tougher rods, this being especially true on rich soil.

Lemleys should also be closely spaced, for they are then able to shade the ground well and to thin themselves.

The Welsh, on the other hand, should not be closely spaced, for even with dense spacing there is not enough shade to keep out the weeds. With wide spacing the rods are much longer than with the closer spacing.

Most of the growers in Maryland use wide spacing in order to facilitate the cutting of the weeds, which is the only cultivation that most of the gardens have. This wide spacing is also due to the fact that when the gardens were first started, this method was followed by the pioneers of the willow culture, and later comers have made no changes. Wide planting is also cheaper as not so many plants are used. The average spacing of willows in Maryland is about 36 to 42 inches for the rows, and 15 to 16 inches for the plants in the rows. The poorer the soil the wider the spacing should be.

Taking all things into consideration for the different species and the different soils, the following spacing is suggested for Maryland:

Spacing for Willows on Different Soils.

Variety.	Rich soil. Inches.	Medium soil. Inches.	Poor soil. Inches.
American Green.....	10 x 24	10 x 24	12 x 30
Lemley and Pat. Lemley..	10 x 24	10 x 24	12 x 36
Welsh or Purple.....	10 x 24	10 x 30	12 x 36

The simplest accurate method of planting is to stretch a line across the garden with the proper spacing of the plants designated by bits of cloth; the cuttings are then placed on the ground at the points so indicated. An average of about seven thousand cuttings can be set out by two men in a day on ordinary soft soil, one man placing the cuttings and the other pressing them firmly into the ground.

Number of Plants per Acre with Different Spacings.

Approximate distance apart.	No. of plants per acre.
18 in. x 6 in.	58,080
24 " x 6 "	43,560
30 " x 9 "	34,848
24 " x 9 "	29,040
24 " x 10 "	26,136
24 " x 12 "	21,780
30 " x 10 "	20,909
36 " x 10 "	17,424
30 " x 12 "	17,424
42 " x 10 "	14,935
36 " x 12 "	14,520
42 " x 12 "	12,445

REPLANTING OPENINGS.

All openings in the garden caused by the death of plants should be filled in during the autumn in order to give them an early start the following spring. Individual plants are continually dying off from various causes, and while the percentage each year is not great, still, if the garden is left for a number of years without replacing, it will in time become poorly stocked and not as easy to return to a normal density.

As has been stated before, two-year-old stock from 4 to 5 feet high should be used, and allowed to grow for two years before establishing a stool. If the replants are too high the second year, so as to shade the older plants, they may be cut back to their original height.

CULTIVATION.

During the first year the garden should be cultivated thoroughly. If the rows are wide enough apart a horse cultivator may be used; otherwise it must be done by hand.

Two or three hoeings the first season and at least two the

PLATE V

FIG. 1. CUTTING

PLATE V

FIG. 2. DRAFTING

second are necessary, as the crown cover is relatively small during this period and the rank growth of weeds which is likely to spring up, must be kept down. After the second year one hoeing is desirable, in the spring. If the weeds do appear they should be cut before their seeds ripen; the weeds can be laid in the rows between the plants and left to rot, thus fertilizing the soil. Cultivation is not so essential on bottom lands that are inundated in the spring, but is very essential on lands that are not flooded if the best results are to be obtained.

The gardens should not be cultivated with a horse for more than the first two or three years, for after that time the roots have fully developed and are more liable to injury from a horse cultivator than with a hoe.

In Farmers' Bulletin 622, of the U. S. Department of Agriculture, the Forest Service offers the following suggestion: that when the garden is first started, the rows be three to four feet apart so that they may be easily gone through with a horse cultivator during the first two years. In the third spring, cuttings should be set in between the existing rows. These cuttings should be 4 to 5 feet tall, as they must compete for light with the already established plants. Thorough cultivation before planting the new cuttings, or sets, saves one hoeing. It is advisable to allow the new plants to grow for two years before cutting them back to the ground.

The more care taken of the garden the first few years, the less it will require in later ones.

The garden should be frequently inspected and all pests—whether weeds, such as morning glory and wrap, or insects, as worms and caterpillars—should be thoroughly cleaned out.

HARVESTING THE CROP.

When to Cut.

The right time to cut willows depends on the method of peeling to be used. In the case of the natural sap peeling, the rods should be cut at least six weeks before peeling and left to stand in the pits. The usual practice is to cut them some time in February when the snow is off the ground, so as to secure low stumps. If artificial spring conditions are to be employed in raising the sap, or steaming is used, the rods may be cut as soon as the leaves are off in the fall.

The stool should be cut as closely as possible, since low stools offer opening, as this causes the stumps to bleed and lose vitality.

How to Cut.

In cutting the rods, only sharp tools should be used. Dull knives make ragged cuts and are liable to pull on the roots more than is neccessary. The best tool to use is a hook knife. Pruning shears are very good but the time required to cut the rods this way is nearly double that of cutting with a knife. The willows are held in one hand and the cutting done by a quick upward stroke of the knife held in the other.

The stool should be cut as closely as possible, since low stool offer less chance of mechanical injury and disease.

PITTING AND DRAFTING.

As the rods are cut, they should be tied in bundles of about an armful each and taken to the pits. The rods are now drafted or sorted into different sizes. This is usually done by placing the rods in a barrel which has been slightly sunk in the ground and the head knocked out. A stick is nailed to the side with the different sizes indicated on it, and the rods inside the barrel graded according to their respective height classes. Two iron hoops may be fastened a few feet part, and substituted for the barrel. Small willows are used to fasten the bundles.

The bundles are now placed in the pits which should be located conveniently to where the peeling is to be done. Too great care cannot be taken to have the butts as even as possible so that they may all rest on the bottom of the pit. Otherwise the sap will not rise and the rods will depreciate. The pits should be shallow, with a supply of water which is easily regulated, for the willows should not stand in more than 2 to 3 inches of water, a greater depth causing discoloration of the butts. The pits should be so placed that no freshets or heavy rains can flood them. The ideal situation is where they are assured a uniform depth of water with little fluctuation, and protection from the wind. Wooden or metal rails or racks, 2 to 3 feet high, are placed around the pits and occasionally across, in order to keep the bundles upright. The bundles should not be packed too closely in the pits.

If the rods are pitted in a cellar or especially constructed house,

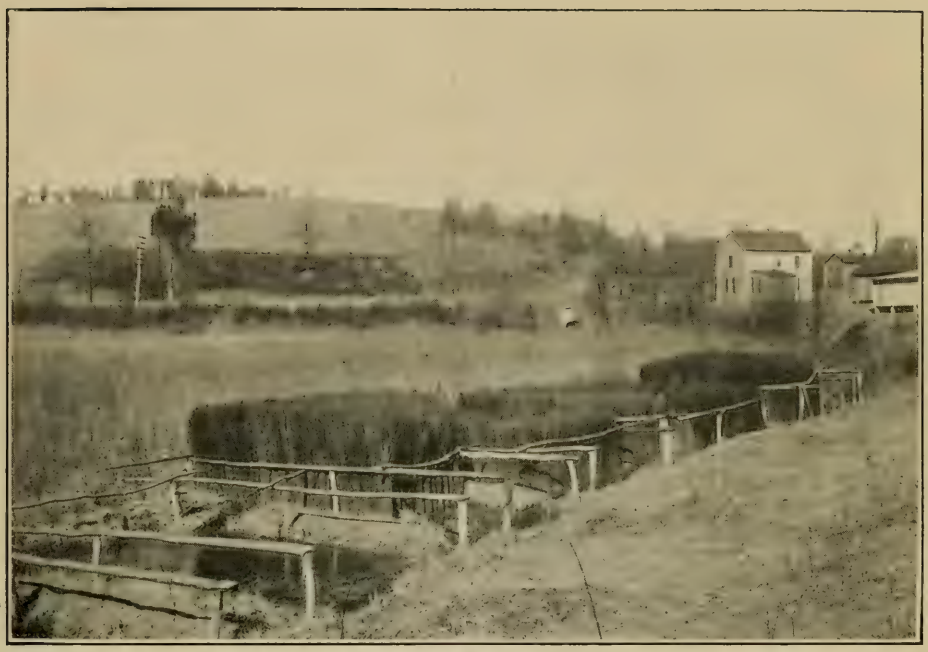

PLATE VI

FIG. 1. PITTED WILLOWS: AMERICAN GREEN, DARK; LEMLEY, LIGHT

PLATE VI

FIG. 2. BREAKING AND PEELING WILLOWS. LANSDOWNE, BALTIMORE

BUNDLING.

If the rods are kept according to their sizes, as they have been peeled, there is no need for further drafting. Otherwise, they must be drafted in the same manner as has been previously explained.

The assorted rods are next made up in bundles and are ready for shipment. Several methods of tying the bundles are in use. The simplest method is one in which a belt or strap is thrown around the bundles where it is to be tied, drawn tight, and fastened, thus forcing the rods tightly together and holding them in place. The bundle is then tied with twine or very small willow rods. A simple machine employed makes use of the same principle, but is operated on a frame supporting a cradle in which the rods are laid. The strap around the rods is operated by a crank, worked by hand or foot power. This machine is easily made by the grower, and saves him time and labor in comparison with the old way of using the strap only. Bundles are usually fastened twice, once near the butt and then about two-thirds of the way up. Exceptionally long rods require an additional fastening.

RETURNS.

Peeled willow rods bring from twelve to twenty-two cents a pound, depending on length and quality.

Production per acre ranges from 1,750 pounds to 2,500 pounds, depending on site and season. This makes the gross returns from $210 to $500 for each acre planted in willow.

The cost of establishing a garden—exclusive of the price of the land, which ranges from $10 to $50 per acre, and its preparation for planting—would be as follows for spacing of 24 x 10 inches:

Cuttings (about 26,500 at $8 per thousand)	$212.00
Planting (two men at $2.50 per day), 3 days	15.00
	$227.00

With spacing of 36 x 12 inches:

Cuttings (about 15,000 at $8 per thousand)	$120.00
Planting (two men at $2.50 per day), 1½ days	7.50
	$127.50

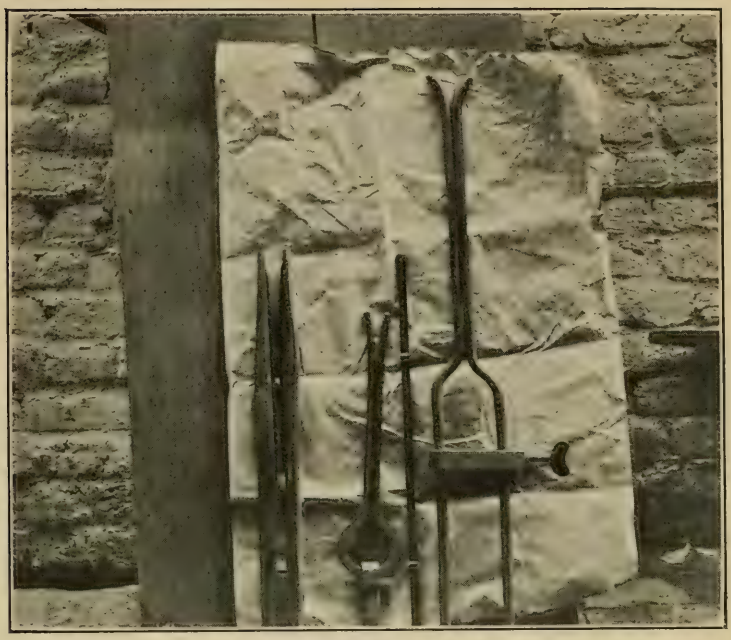

PLATE VII

FIG. 1. TOOLS USED IN BREAKING WILLOW RODS

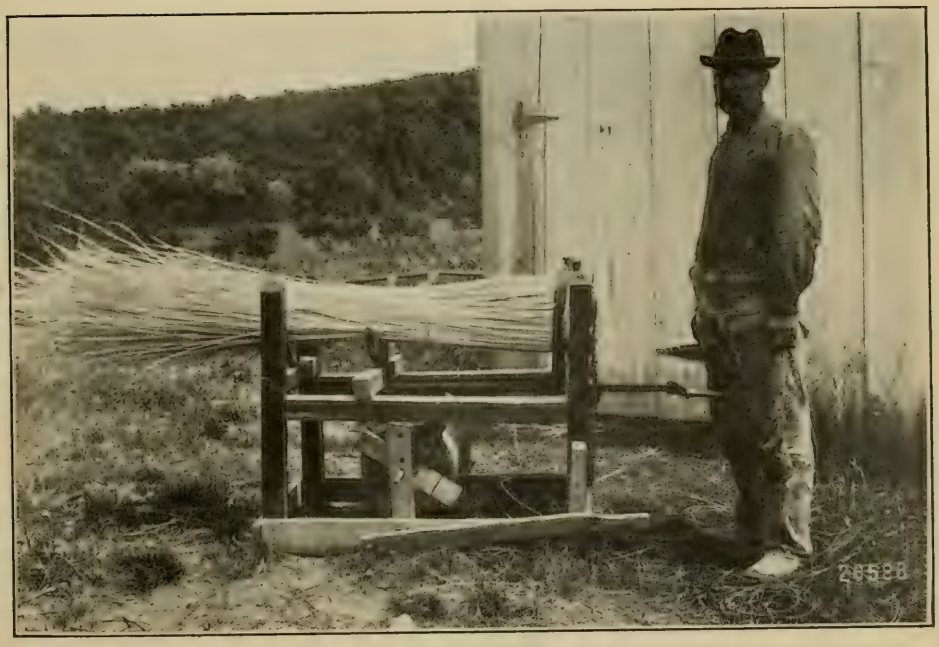

PLATE VII

FIG. 2. INSTRUMENTS USED FOR BUNDLING WILLOWS

The cost of raising crops of willows of 1,750 pounds to 2,500 pounds per acre, exclusive of buying the land and stock, and planting, would be as follows:

Cultivating	$20 to	$50
Cutting (three men crew)	50 to	75
Peeling (one man, two women crew)	50 to	100
Bundling	5 to	7
	$125	$232

This would give, after the garden has been started, a net annual return of about $75 to $200 per acre.

The average length of life of closely-spaced plants is about 8 to 9 years, wide-spaced plants, 10 to 12 years. Close-spaced gardens, however, give a larger yield, which offsets the shorter life. If the garden, or portions of it in rotation, are allowed about every five years to go for a season without cutting, it will improve the yield and lengthen the life of the garden.

When openings are filled in and the garden kept fully stocked, and in good condition, there is no limit to its productivity.

MARKETS.

Baltimore is the center of the Willow Industry in Maryland. In its immediate vicinity are located the majority of basket and furniture makers, as well as the gardens themselves. The manufacturers take most of the willow crop grown in this State, besides importing a large amount from other States. The reason for the use of the imported willows is that the rods are smaller and often better sorted. The native growers do not like to produce the short rods, because it is relatively more expensive.

Willow is frequently used to wrap nursery stock, and baskets of unpeeled rods are also used to transport the smaller plants. These baskets have the double advantage over wooden boxes of being light, and more easily and cheaply handled.

Now that the European supply has diminished, more attention should be paid to the native production of willows. With the application of scientific methods, the industry should very soon assume a place of actual importance.

APPENDIX

ENEMIES OF THE WILLOW.

Atmosphere.

DRY WEATHER is bad, especially in the spring, as it induces the blight and stunts the growth of the rods. If the gardens can be flooded or irrigated, it should be occasionallly resorted to in case of a long protracted dry spell.

Hail storms are very injurious, because they tear through the bark and bruise the wood. This makes an unsightly spot on the peeled rod, reducing the commercial value greatly.

Plant Life—Parasitic.

THE DODDER, *Cuseuta epithymun,* is commonly known as "wrap." This is one of the worst pests of the Willow Garden. The small black seed is carried in by the overflowing of the gardens, and is also distributed by birds, which feed on it. The seeds germinate in the ground in the late spring and send up a minute thread, which wraps around the willow, taking root in its inner bark. The connection with the ground immediately dies. This dodder is very harmful to the rods, for wherever it has taken root in the willow, black marks are left, spoiling the appearance and also rendering it brittle at that point. The only method of keeping this under control is to go through the garden at least every two weeks and strip the vines wherever it appears. Especial care should be used in not letting the seed come to maturity in late August or early September. If the dodder is found early and kept stripped it does not have as great damaging effect as if allowed to grow unhindered.

THE RUST, *Melapsora Hartigi,* commonly called the Blight, has only been found on the American Green willows and seems to be induced by dry weather in the spring, especially in sandy soil. Here the sand becomes heated during the day, and when the cool night air strikes it, a fog is created which fosters the development of the blight.

About the beginning of June, small reddish clusters appear on

PLATE VIII

FIG. 1. WILLOW FURNITURE

PLAT E VIII

FIG. 2. WILLOW BASKETS

the under side of the leaf—usually in the newest growth—and work downward. The last stage, in the fall, remains on the fallen leaves over winter and from these old leaves the new growth is infected the following spring. This rust is very destructive and deadens the rod. Several successive years of this blight will kill a stump.

Spraying with a lime-sulfur solution, and raking and burning the leaves in the fall is the best remedy.

MILDEW, *Erysiplie adunca,* is found on the willows, especially Lemley, but is not very harmful.

BLACK SPOTS, one of the *Rhytisma,* a fungus, is also found on the leaves of willows, but does not particularly injure the rods.

Plant Life—Non-Parasitic.

MORNING GLORY, species of *Convolvulus.* This weed does immense damage to the willow by climbing around the rods or binding several together, causing them to fall over. The tight binding around the stem also leaves welts on the rods. Continual pulling up of the vines and not allowing them to go to seed is the only remedy.

WILD HOP, species of *Polygomiun,* acts similarly to the morning glory in bending the willows, but if once pulled up will not sucker.

Animal Enemies.

MUSKRATS, MICE and sometimes RABBITS often do damage to a willow garden by gnawing off the shoots in winter. Traps are the most effective method of combating them.

Insects.

THE WILLOW SAWFLY, *Janus integer.* This insect stings the top of the willow shoot and lays its egg, at the same time girdling the twig to prevent further growth. The eggs are laid in June and very soon the young larva or grub burrows down in the center, becoming dormant, or in the pupa stage, in September. The dormant stage is passed in the center shoot. American Green and Welsh are the most susceptible.

The best method of control is to cut back the tips of the affected shoots. As soon as these begin to wilt they should be cut off three inches below the point where the stem is girdled. These tips can be left on the ground or burned.*

Other Insects. There are many other insects, such as caterpillars, which defoliate the plant. These may easily be controlled by spraying with some arsenical preparation.

* U. S. Department of Agriculture. Bulletin 46.

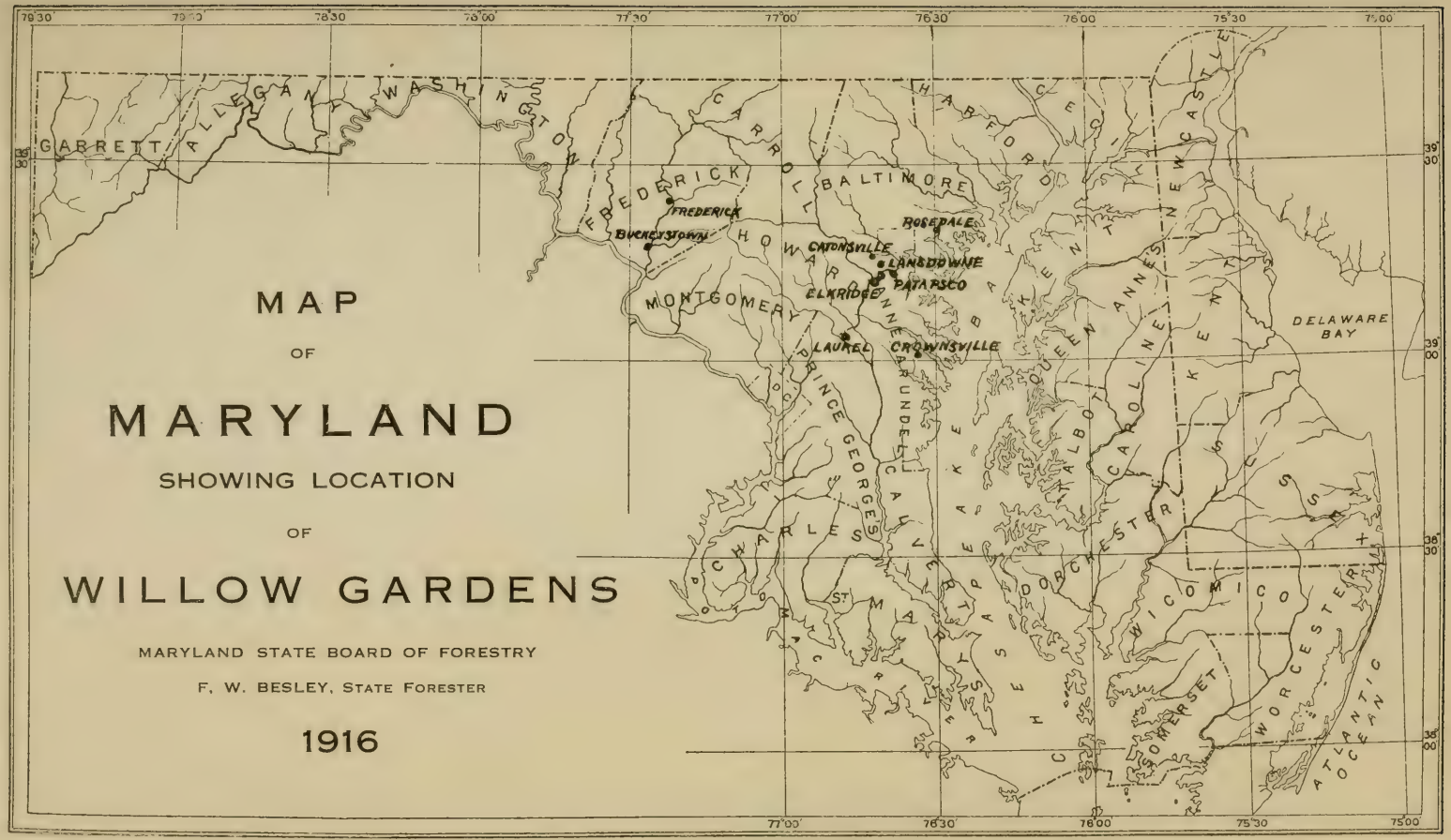
MAP
OF
MARYLAND
SHOWING LOCATION
OF
WILLOW GARDENS
MARYLAND STATE BOARD OF FORESTRY
F. W. BESLEY, STATE FORESTER
1916
GARRETT
ALLEGANY
WASHINGTON
FREDERICK
CARROLL
BALTIMORE
HARFORD
CECIL
NEWCASTLE
KENT
DELAWARE BAY
FREDERICK
BUCKEYSTOWN
ROSEDALE
CATONSVILLE
LANSDOWNE
PATAPSCO
ELKRIDGE
HOWARD
MONTGOMERY
LAUREL
CROWNSVILLE
ANNE ARUNDEL
QUEEN ANNES
PRINCE GEORGES
CHARLES
CALVERT
ST. MARYS
PATUXENT RIVER
CHESAPEAKE BAY
TALBOT
CAROLINE
DORCHESTER
WICOMICO
SOMERSET
WORCESTER
ATLANTIC OCEAN
79°30
79°00
78°30
78°00
77°30
77°00
76°30
76°00
75°30
75°00
39°30
39°00
38°30
38°00

TABLE OF WILLOW GROWERS AND GARDENS IN THE STATE.

ELKRIDGE.

Name of Owner and Address	Acres Lemley	Am. Green	Welsh	Total
J. T. Martin, Elkridge	3.	4.	..	7.00
Anton Skrivonick, Elkridge	10.	8.	1.	19.00
Cyril Peleska, Elkridge	9.	1.	1.	11.00
Robert Hawkins, Elkridge	3.	2.	.50	5.50
Charles E. Pitzinger, Elkridge	1.	2.	..	3.00
John Pitzinger, Sr., Lansdowne	5.50	7.50	2.	15.00
John Pitzinger, Jr., Hanover	5.	4.	1.	10.00
Total Acreage Elkridge District	36.50	28.50	5.50	70.50

LANSDOWNE.

Henry Link, Halethorpe, R. F. D.	2.50	1.	.25	3.75
Cris Kaline, Halethorpe, R. F. D.	2.75	2.75	.25	5.25
Michael Reitz, Halethorpe, R. F. D.	..	.50	..	.50
Fred. Link, Halethorpe, R. F. D.	.50	.75	.25	1.50
Katy Graysaker, Winans Station, P. R. R.	.50	2.	.50	3.00
Mrs. R. Voetsch, Halethorpe, R. F. D.	..	3.	..	3.00
J. W. Siebert, 546 W. Conway St., Balto.	2.	.50	.50	3.00
Frank Ciner, Lansdowne	.50	.50	.25	1.25
Total Acreage Lansdowne District	8.25	11.00	2.00	21.25

PATAPSCO.

Frank Kaiss, Lansdowne, R. F. D.	1.	1.50	..	2.50
M. Richwein, 815 W. Lexington St., Balto.	4.	7.	.50	11.50
John Robinson, Lansdowne, R. F. D.	..	4.	..	4.00
Sweetcjer Linthicum	1.	2.	..	3.00
Total Acreage Patapsco District	6.00	14.50	.50	21.00

ROSEDALE.

Louis Hanzlick, Rosedale	2.	1.	..	3.00
Louis Marden, Rosedale	4.	1.	..	5.00
Total Acreage Rosedale District	6.00	2.00	..	8.00

CROWNSVILLE.

Crownsville State Hospital, Crownsville	3.00	5.00	2.00	10.00

CATONSVILLE.

Name of Owner and Address	Acres Lemley	Am. Green	Welsh	Total
Spring Grove State Asylum, Catonsville....	1.00	..	2.00	3.00

LAUREL.

J. Lohrig, 203 N. Wolfe St., Baltimore.....	20.00	..	5.00	25.00

TUSCORORA.

Curtis Geiser, 349 Madison St., Frederick..	5.00	12.00	6.00	23.00

TOTAL ACREAGE.

Elkridge District	36.50	28.50	5.50	70.50
Lansdowne District	8.25	11.00	2.00	21.25
Patapsco District	6.00	14.50	.50	21.00
Rosedale District	6.00	2.00	..	8.00
Crownsville District	3.00	5.00	2.00	10.00
Catonsville District	1.00	..	2.00	3.00
Laurel District	20.00	..	5.00	25.00
Tuscorora District	5.00	12.00	6.00	23.00
Total Acreage State.....	85.75	73.00	23.00	181.75